Overview of the Threat Posed by Insiders to Critical Assets

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David Mundie is a member of the CSIRT Development Team within the CERT® Program at the Software Engineering Institute (SEI), a unit of Carnegie Mellon University in Pittsburgh, PA. He has been at CERT since 2000 and has worked in a variety of areas including insider threat, malware analysis, and incident management capability metrics. From 2006 to 2009, he was a member of the Q-CERT project, which established a national information security team for the country of Qatar.

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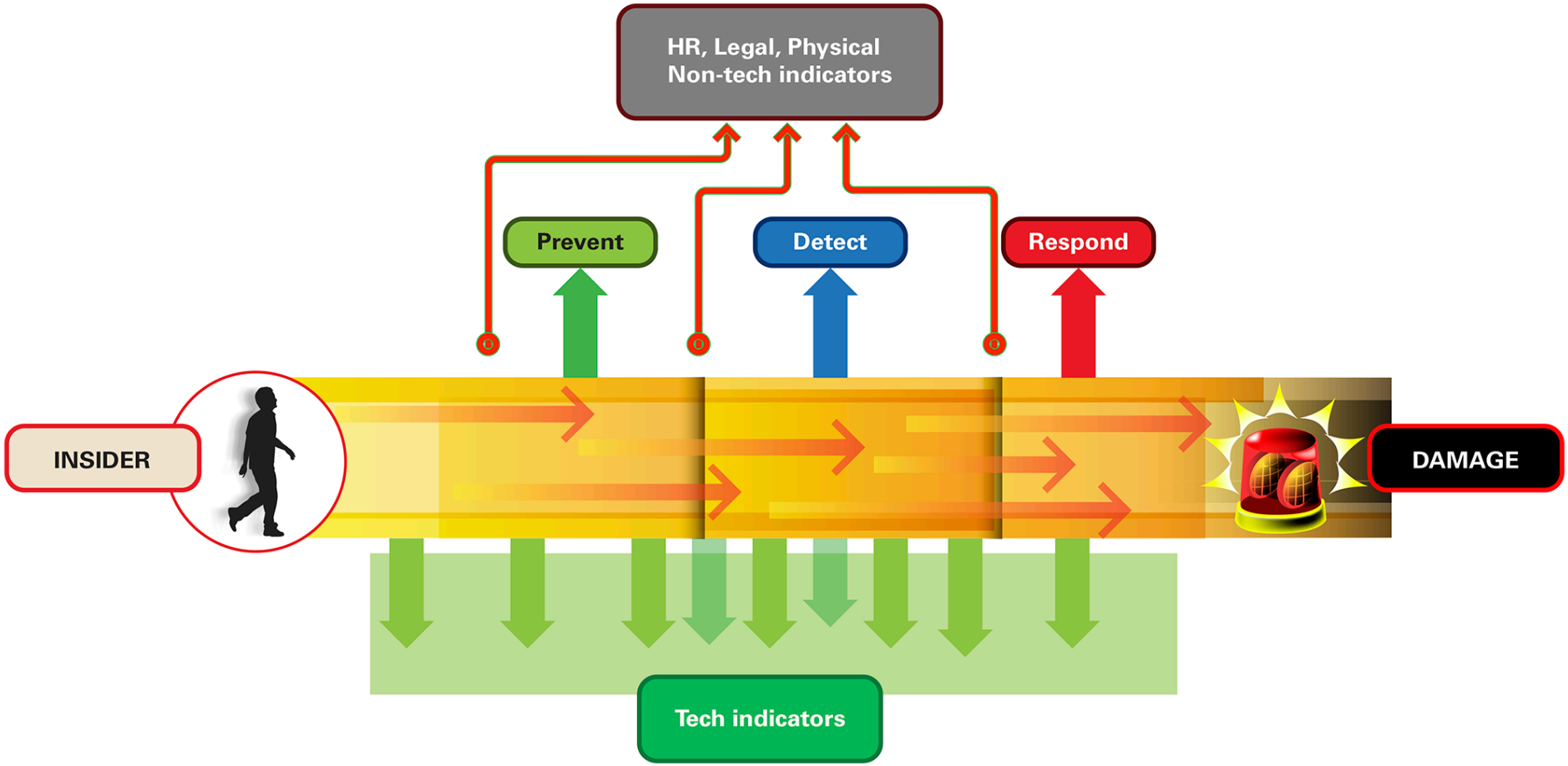
What is the CERT Insider Threat Center?

Center of insider threat expertise

Began working in this area in 2001 with the U.S. Secret Service

Our mission: *The CERT Insider Threat Center conducts empirical research and analysis to develop & transition socio-technical solutions to combat insider cyber threats.*

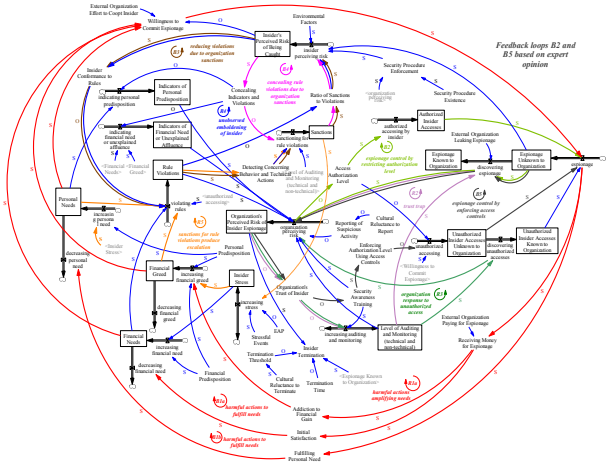
Goal for an Insider Threat Program



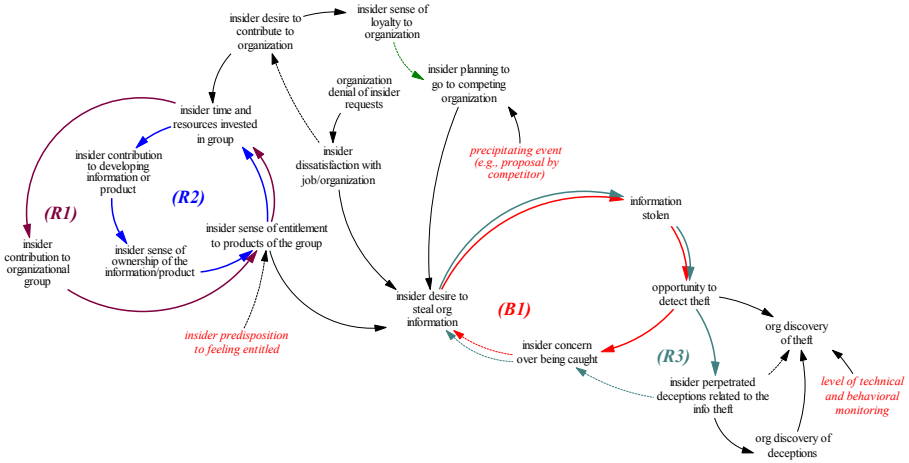
Opportunities for prevention, detection, and response for an insider incident

CERT's Unique Approach to the Problem

Research Models



Deriving Candidate Controls and Indicators



Our lab transforms that into this…

```
Splunk Query Name: Last 30 Days - Possible Theft of IP
Terms: 'host=HECTOR [search host="zeus.corp.merit.lab" Message="A user account was
disabled. *" | eval Account_Name=mvindex(Account_Name, -1) | fields Account_Name | strcat
Account_Name "@corp.merit.lab" sender_address | fields - Account_Name] total_bytes > 50000
AND recipient_address!="*corp.merit.lab" startdaysago=30 | fields client_ip,
sender_address, recipient_address, message_subject, total_bytes'
```

The Insider Threat

There is not one “type” of insider threat

- Threat is to an organization’s critical assets
  - People
  - Information
  - Technology
  - Facilities
- Based on the motive(s) of the insider
- Impact is to Confidentiality, Availability, Integrity

There is not one solution for addressing the insider threat

- Technology alone may not be the most effective way to prevent and/or detect an incident perpetrated by a trusted insider

Separate the "Target" from the "Impact" from the "Actor"

Target	Impact	Actor(s)
Critical Assets • People • Technology • Information • Facilities	Confidentiality Availability Integrity	Employees • Current • Former Contractors Subcontractors Suppliers Trusted Business Partners
WHAT	HOW	WHO

What is a Malicious Insider Threat?

Current or former employee, contractor, or other business partner who

- *has or had authorized access to an organization's network, system or data and*
- *intentionally exceeded or misused that access in a manner that*
- *negatively affected the confidentiality, integrity, or availability of the organization's information or information systems.*

What is an Unintentional Insider Threat?

Current or former employee, contractor, or other business partner who

- *who has or had authorized access to an organization's network, system, or data and who, through*
- *their action/inaction without malicious intent*
- *cause harm or substantially increase the probability of future serious harm to the confidentiality, integrity, or availability of the organization's information or information systems.*

Types of Insider Crimes

Insider IT sabotage
An insider's use of IT to direct specific harm at an organization or an individual.
Insider theft of intellectual property (IP)
An insider's use of IT to steal intellectual property from the organization. This category includes industrial espionage involving insiders.
Insider fraud
An insider's use of IT for the unauthorized modification, addition, or deletion of an organization's data (not programs or systems) for personal gain, or theft of information which leads to fraud (identity theft, credit card fraud).
National Security Espionage
The act of stealing and delivering, or attempting to deliver, information pertaining to the national defense of the United States to agents or subjects of foreign countries, with intent or reason to believe that is to be used to the injury of the United States or to the advantage of a foreign nation.

Insider Crime Profiles

IT Sabotage

TRUE STORY:

SCADA systems for an oil-exploration company is temporarily disabled…

A contractor, who's request for permanent employment was rejected, planted malicious code following termination

Other Cases of IT Sabotage

Financial Institution customers lose all access to their money from Friday night through Monday

- Fired system administrator sabotages systems on his way out

A subcontractor at an energy management facility breaks the glass enclosing the emergency power button, then shuts down computers that regulate the exchange of electricity between power grids, even though his own employer had disabled his access to their own facility following a dispute.

- Impact: Internal power outage; Shutdown of electricity between the power grids in the US.

Former employee of auto dealer modified vehicle control system after being laid off

- Searched for known customers and sent out unwarranted signals to vehicle control devices disabled ignitions and set off alarms

A security guard at a U.S. hospital, after submitting resignation notice, obtained physical access to computer rooms

- Installed malicious code on hospital computers, accessed patient medical records

Summary of Insider Threats

	IT Sabotage
Current or former employee?	Former
Type of position	Technical (e.g. sys admins, programmers, or DBAs)
Gender	Male
Target	Network, systems, or data
Access used	Unauthorized
When	Outside normal working hours
Where	Remote access

Fraud

TRUE STORY:

An undercover agent who claims to be on the "No Fly list" buys fake drivers license from a ring of DMV employees...

The 7 person identity theft ring consisted of 7 employees who sold more than 200 fake licenses for more than $1 Million.

Other Cases of Fraud

An accounts payable clerk, over a period of 3 years, issued 127 unauthorized checks to herself an others...

- Checks totaled over $875,000

A front desk office coordinator stole PII from hospital...

- Over 1100 victims and over $2.8 M in fraudulent claims

A database administrator at major US Insurance Co. downloaded 60,000 employee records onto removable and solicited bids for sale over the Internet

An office manager for a trucking firm fraudulently puts her husband on the payroll for weekly payouts, and erases records of payments…

- Over almost a year loss of over $100K

Summary of Insider Threats

	IT Sabotage	Fraud
Current or former employee?	Former	Current
Type of position	Technical (e.g. sys admins, programmers, or DBAs)	Non-technical (e.g. data entry, customer service) or their managers
Gender	Male	Fairly equally split between male and female
Target	Network, systems, or data	PII or Customer Information
Access used	Unauthorized	Authorized
When	Outside normal working hours	During normal working hours
Where	Remote access	At work

Theft of Intellectual Property

TRUE STORY:

Research scientist downloads 38,000 documents containing his company's trade secrets before going to work for a competitor…

Information was valued at

$400 Million

Other Cases of Theft of IP

A technical operations associate at a pharmaceutical company downloads 65 GB of information, including 1300 confidential and proprietary documents, intending to start a competing company, in a foreign country…

- Organization spent over $500M in development costs

Simulation software for the reactor control room in a US nuclear power plant was being run from outside the US…

- A former software engineer born in that country took it with him when he left the company.

Summary of Insider Threats

	IT Sabotage	Fraud	Theft of Intellectual Property
Current or former employee?	Former	Current	Current (within 30 days of resignation)
Type of position	Technical (e.g. sys admins, programmers, or DBAs)	Non-technical (e.g. data entry, customer service) or their managers	Technical (e.g. scientists, programmers, engineers) or sales
Gender	Male	Fairly equally split between male and female	Male
Target	Network, systems, or data	PII or Customer Information	IP (trade secrets) –or customer Info
Access used	Unauthorized	Authorized	Authorized
When	Outside normal working hours	During normal working hours	During normal working hours
Where	Remote access	At work	At work

Ontologies for Insider Threat Research

Vision

The most important attributes would be the construction of a common language and a set of basic concepts about which the security community can develop a shared understanding… a common language and agreed-upon experimental protocols will facilitate the testing of hypotheses and validation of concepts. –Jason Report

Medical Ontologies

OLSVis

Gene Ontology (GO)

• roots
+ filters

nucleus

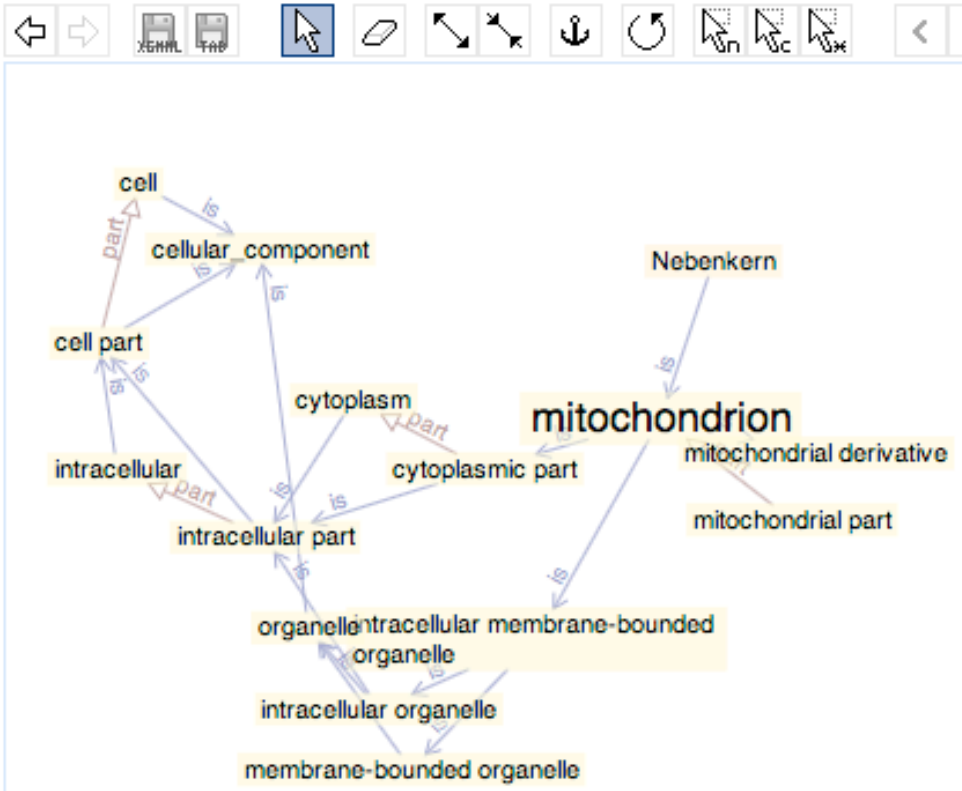
mitochondrion *(GO:0005739)*

A semiautonomous, self replicating organelle that occurs in varying numbers, shapes, and sizes in the cytoplasm of virtually all eukaryotic cells. It is notably the site of tissue respiration.

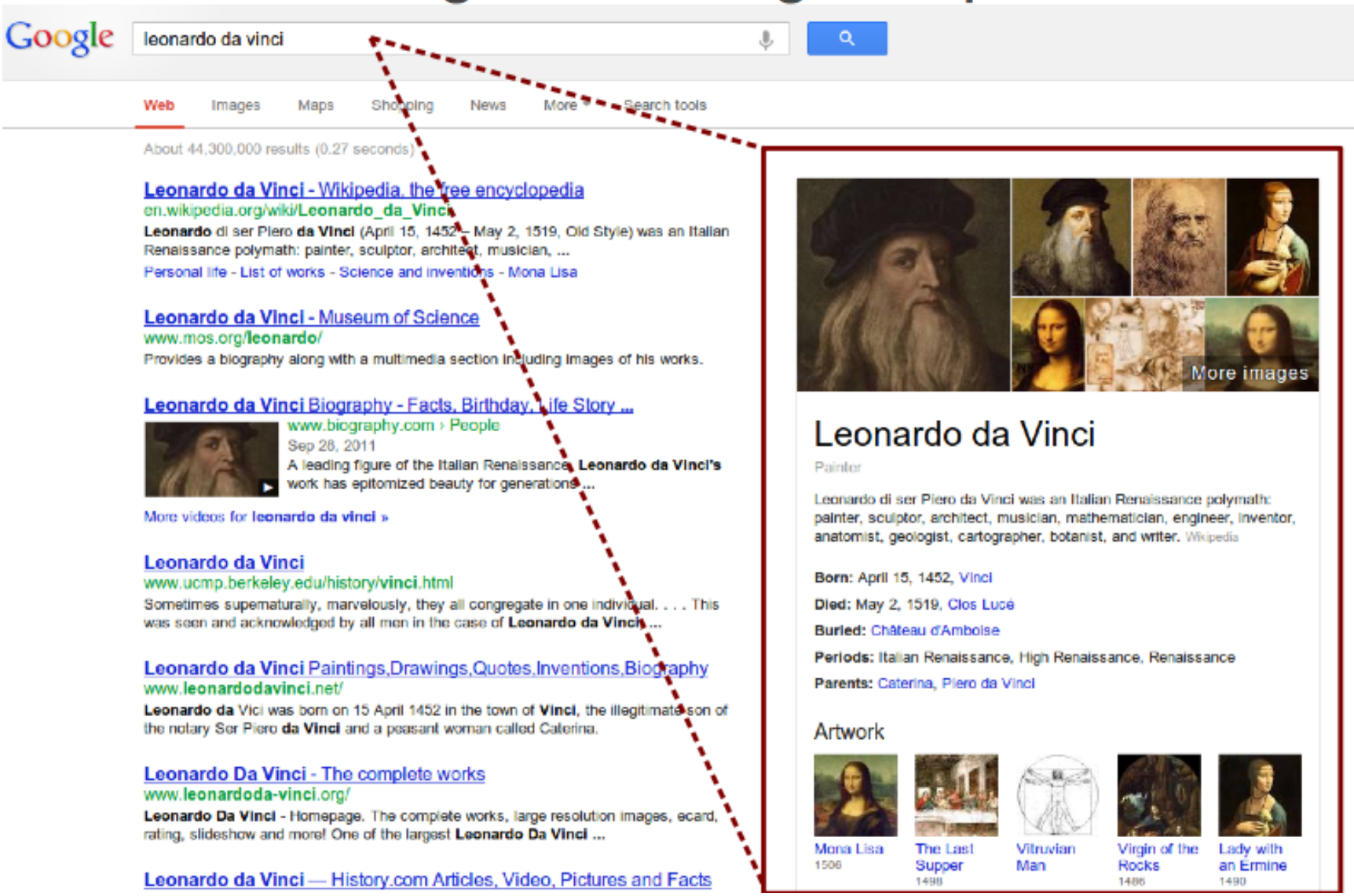
exact synonym:	mitochondria
subset goslim aspergillus:	Aspergillus GO slim
subset goslim candida:	Candida GO slim
subset goslim generic:	Generic GO slim
subset goslim metagenomics:	Metagenomics GO slim
subset goslim pir:	PIR GO slim
subset goslim plant:	Plant GO slim
subset goslim yeast:	Yeast GO slim
xref definition:	ISBN:0198506732
xref analog:	NIF_Subcellular:sao1860313010
xref analog:	Wikipedia:Mitochondrion

Child terms:

- mitochondrial derivative
- mitochondrial part
- Nebenkern



Google Knowledge Graph



Google Knowledge Graph (cont.)

- Huge "semantic network" of over 570 million objects and 18 billion facts (500 million objects and 3.5 billion facts)
- Sources:CIA World Factbook, Wikipedia, Freebase
- Facts about: people, actors, directors, movies, cities, countries, recipes, etc.
- Available in multiple languages; localized search results

http://googleblog.blogspot.co.uk/2012/05/introducing-knowledge-graph-things-not.html
http://www.newyorker.com/online/blogs/culture/2012/05/google-knowledge-graph.html
http://venturebeat.com/2013/01/22/larry-page-on-googles-knowledge-graph-were-still-at-1-of-where-we-want-to-be/
http://news.cnet.com/8301-1023_3-57435114-93/google-bringing-new-smarts-to-search-with-knowledge-graph/

Ontology Work at CERT

Incident Management

- Incident Management Body of Knowledge
- MAL: Ontology-based Competency Model

General

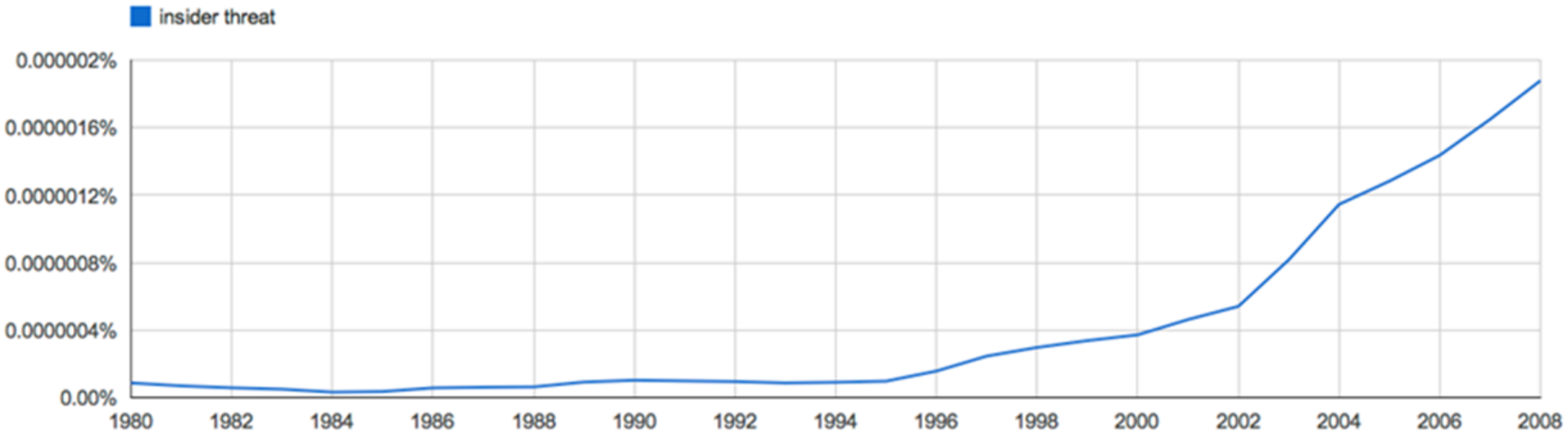
- 10-step methodology for developing ontologies
  - Terms, controlled vocabulary, static relationships, dynamic relationships

Insider Threat

- Lexicographic insider threat ontology
- Trust ontology
- Indicator ontology
- Unintentional insider threat ontology

A Lexicographic Ontology of Insider Threat

From Lexicography to Ontology



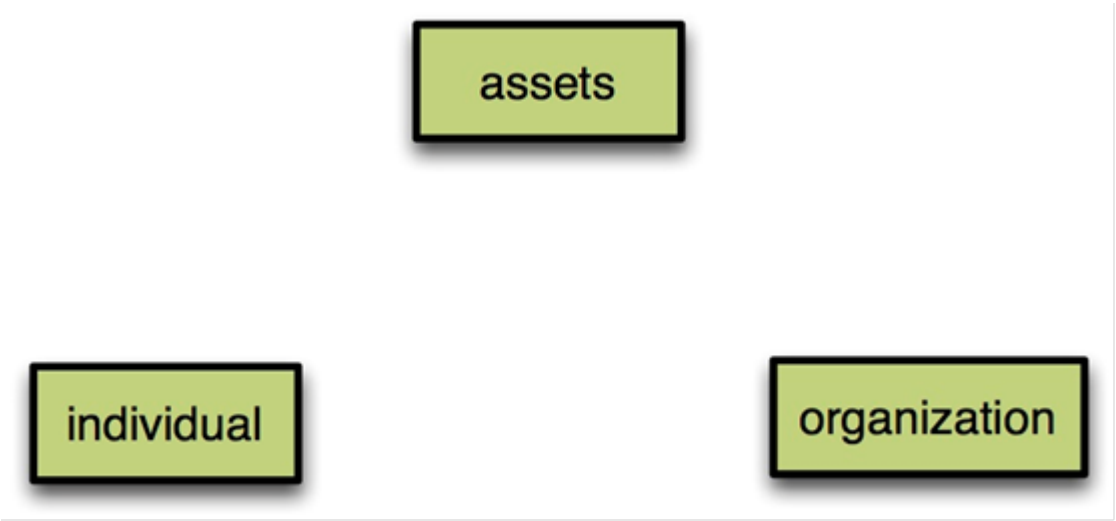
42 Definitions

- Encountered during a literature search
- Two example definitions
  - *is someone who is authorized to use computers and networks*
  - *is anyone who operated inside the security perimeter*

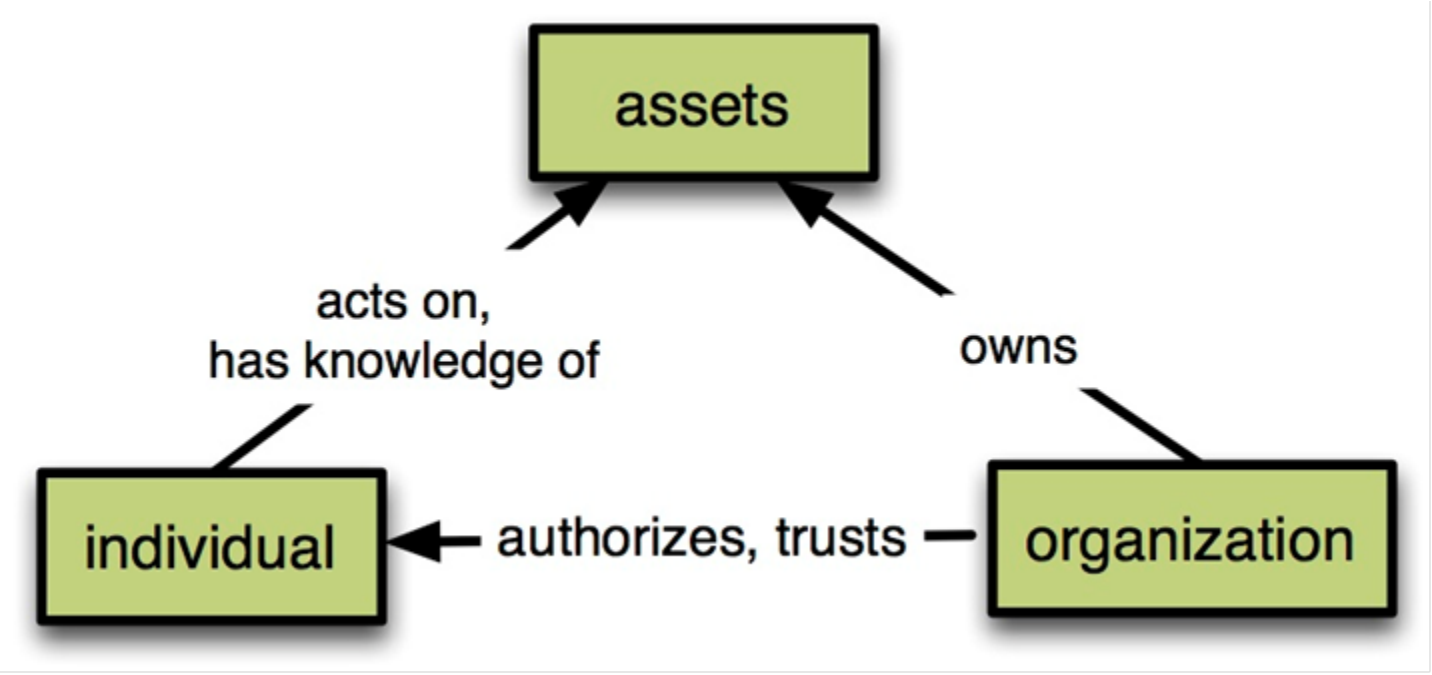
From Natural Language to Formal Language

- **Inspired by Travis Breau**
- *captured state notification laws in DL*
- Looks like this:
- *is(insider, anyone(authorized to use(computers and networks)))*
- *is(insider, anyone(operating inside (security perimeter)))*

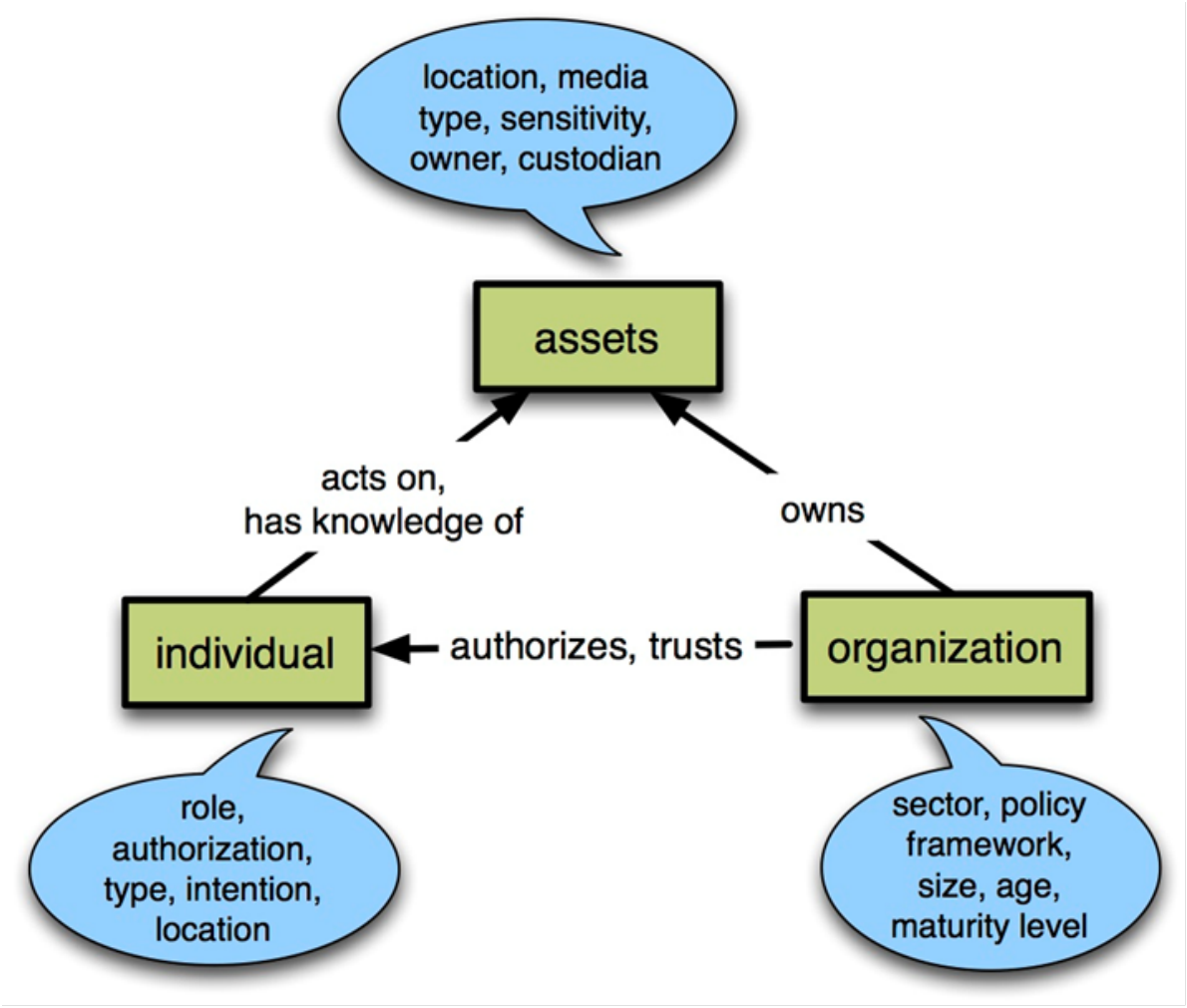
From Formal Language to Structure



From Formal Language to Structure



From Formal Language to Structure



Draft Ontology

An Ontology for Insider Threat Indicators

Design Goals

- Goal # 1: Focus on detection
- Goal # 2: Make indicator definition simple
- Goal # 3: Be agnostic and compatible with existing models
- Goal # 4: Be easily extensible

- Assumption #1: The focus should be on the person
- Assumption #2: Indicators should target significant events

The Ontology in OWL

A Sample Indicator

Indicators use simple subject-verb-object (SVO) syntax borrowed from natural language.

if entity:securityRoleEntity:systemAdministrator

performs action:dataMovementAction:egress:printing

on object:dataObject:anyDataObject

within time:definedScheduleTime:non-work-hours

perform analysis:binaryAnalysis

A Sample Indicator

Indicators use simple subject-verb-object (SVO) syntax borrowed from natural language.

if systemAdministrator

performs printing

on anyDataObject

within non-work-hours

perform binaryAnalysis

CERT's Insider Threat Services

Insider Threat Assessment (ITA)

Objective: To measure an organization's level of preparedness to address insider threats to their organization.

Method: Document Review, Process Observation, and Onsite interviews using insider threat assessment workbooks based on all insider threat cases in the CERT case library.

Outcome: Confidential report of findings with findings and recommendations.

Areas of Focus: Information Technology/Security; Software Engineering; Data Owners; Human Resources; Physical Security; Legal / Contracting; Trusted Business Partners.

CERT Insider Threat Workshops

Goal: participants leave with actionable steps they can take to better manage the risk of insider threat in their organization

½ day, One day, Two days - Presentations and interactive exercises

Addresses technical, organizational, personnel, security, and process issues

Exercises

- Address portions of the insider threat assessment
- Purpose: assist participants in assessing their own organization's vulnerability to insider threat in specific areas of concern

Building an Insider Threat Program

Goal: CERT staff work with senior executives from across the organization to develop a strategic action plan, based on actual cases of insider threats at the participating organization and research by CERT staff, to address and mitigate the risk of insider threat at the organization.

- Key differences from standard workshop
  - Tailored course material based on actual insider incidents at the organization.
    - Cases are provided in advance by the organization, and treated with strict confidentiality.
    - Workshop is preceded by a 3-day onsite by CERT staff to work with the organization's staff to familiarize themselves with the provided case material.
  - Second day of workshop CERT staff and executives work together to create the Organization's strategic plan for preventing, detecting and responding to insider threats.

CERT Resources

Insider Threat Center website (http://www.cert.org/insider_threat/)

Common Sense Guide to Mitigating Insider Threats, 4th Ed. (http://www.sei.cmu.edu/library/abstracts/reports/12tr012.cfm)

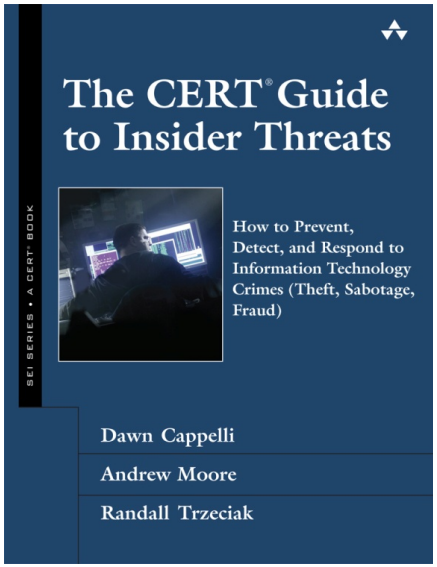
Insider threat workshops

Insider threat assessments

New controls from CERT Insider Threat Lab

Insider threat exercises

The CERT® Guide to Insider Threats: How to Prevent, Detect, and Respond to Information Technology Crimes (Theft, Sabotage, Fraud) (SEI Series in Software Engineering) by Dawn M. Cappelli, Andrew P. Moore and Randall F. Trzeciak



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